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Teaching to All the (Paleo) Brains in the Room

Fall 2017

Over the last 10 years, independent schools have grappled with three domains of new learning. The first falls roughly under the heading of reimagining education for the 21st century. This includes the (possibly overused) phrase “21st Century Learning” as well as Design Thinking, the Four (or Five or Six?) C’s, Schools of the Future, and the Maker and Tinkering movements. The second is our quest to understand the implications for our schools of current neuroscience. And the third is our expanding attempts to support a wider range of learners, as evidenced by the proliferation and growth of resource support centers. As it turns out, an expanding body of neuroscientific research over the past 15 years suggests that the creative, multisensory, and collaborative frameworks of 21st century learning are strongly aligned with how the brain has always learned best and are, in fact, ideal for *all* students, both those who have struggled with more traditional models and our more advanced students.

You Have a Paleo Brain

As much as we congratulate ourselves over humankind’s modern technological prowess, our brains are basically as they were 40,000 years ago. A major difference between our brains then and now is that our Paleolithic forebears made much broader use of their brains’ abilities. Everyone was physically fit, moving as much as 12 miles a day in search of basic needs. Everyone was a hunter or gatherer, identifying, sorting, and classifying plant and animal life into categories of edibility, medicinal value, and poisonousness. Everyone was inventive by necessity, making what was needed, repairing critical tools, and using hands and minds in concert to solve problems of daily living. Everyone was a dancer, a drummer, a flute-maker, expressing the ancient urge of creativity. Everyone lived in strong

social bond with one another as a matter of survival, raising children as a village, telling stories of shared history that held crucial lessons, and passing down learning that was critical for ensuring subsequent generations. In short, our brains were made to allow us to survive in a highly physical, fairly hostile world that forced us to shift rapidly and creatively and to adapt to conditions as they came at us in fast-moving, three-dimensional space.

Needless to say, even the most innovative or progressive classroom provides a much less stimulating environment than we lived in millennia ago. The good news is that several educational initiatives, especially those under the banner of innovation or 21st century learning, are better aligned with our paleo brains than the traditional classroom, and that is because they include key elements that make for a more enriched learning experience and allow our brains to thrive. Educators often say that many of the careers our current students will pursue do not yet exist. If this prediction holds true, and it almost certainly will, we need to make a shift in schools from a subject orientation to one of teaching students flexibility and adaptation, much like our Paleolithic ancestors were forced by their environment to have. Whatever subjects we teach, our ultimate goal is to help students build a more adaptive, flexible brain. To do so, educators should consider several overarching concepts that can make any classroom a stronger brain-developing place.

1. We are multisensory beings.

Why is multisensory learning so important and so powerful? The answer lies in how we learn and make memories. Our brains are powerful multisensory processors, connected to multiple sensors in the form of our eyes, ears, hands, tongue, nose, vestibular system, proprioceptive system, and many others. In fact, far beyond the five senses we were taught about in school, we have by some scientists' accounts more than 20. And our brains are made to use them all in concert to make sense of our world. Unfortunately, schools drastically limit the sensor set to just a few, such as listening to a teacher and reading text. In doing so, they seriously undermine the brain's memory system, which was designed to learn through all of the body's modalities. In research studies, multisensory learning consistently confers significantly stronger learning and retention than traditional methods, and the reason for that is found in how we form memories.

When you experience something, it starts as a sensation from the physical world, like light, sound waves, or pressure, and it is processed by the parts of the cortex matching those senses. Those cortical areas have projections to the hippocampus, which communicates with the cortex back and forth over a sometimes lengthy

period of time, until the long-term memory is formed, residing primarily in the parts of the cortex that originally encoded it. That last part is critical: *Memories ultimately encode in the cortex that originally processed the sensory input.* Said simply, the more cortex you use in learning, which is the same thing as saying the more senses you use in learning, the more physical brain paths you are putting to use at the same time. Think of watering a garden with one hose or with four hoses at the same time. One modality is a single hose (i.e., listening to a lecture); multiple modalities are multiple hoses (i.e., combining sound, visuals, movement, emotion, oral language, etc.). This is the heart of why multisensory learning is so effective and why, when you combine many modalities, you learn things faster with less effort, and the learning is more durable. It also makes for stronger recall because the different parts of the cortex wire with each other into a network, and any one of the different sensory paths, like a sound, a thought, or an image, can trigger the whole memory.

Tips:

- Brainstorm with colleagues how you can add multisensory, multipath activities to lessons.
- If you are planning on giving a straight-up note-taking lecture, reconsider! Design other ways to present information to enhance the oral/verbal.
- Teach students to say it, write it, and read it when learning new information.
- Field experiences provide natural multisensory learning opportunities.

2. We are meant to move.

We are physical beings meant to learn while navigating a moving, changing, three-dimensional world. This is so true that in rare cases where infants are born without the ability to move, they don't develop cognition. There is a direct connection between movement, physical fitness, and our thinking. It is disheartening to see schools cutting PE and other opportunities for movement when studies have shown that fitter students perform better in academics. In fact, schools actually show *gains* in learning outcomes by taking time away from coursework to increase cardiovascular exercise. The benefits from movement certainly extend far beyond academics. Students who move more and who are fitter have better emotional regulation, better attentional regulation, and better overall health.

Tips:

- When you ask students to discuss with one another, have them take a walk together on campus.
- If you have groups discussing together, give them a wall poster or whiteboard space, and let them have a standing group meeting.
- If you are discussing controversial questions, define one end of the room as one side of the argument, the other end as the opposing point of view, and the room itself as the continuum between the polar views. Have the students stand in a place that represents the strength of their position. You can then have students discuss with like-minded students or ask them to pair with a classmate who is standing farther away and discuss why they are in disagreement.

3. We are all artists.

Our paleo brains are wired to create. The fact that schools are reducing or cutting arts programs runs completely contrary to what the brain wants, and, moreover, it is inconsistent with research on the role of the arts in learning. For example, researchers have established a connection between musical training and development of phonological awareness skills (a precursor to reading). Rhythm training has additive effects in remediation efforts for dyslexic students. Playing a musical instrument engages multiple parts of the brain simultaneously (e.g., motor, auditory, and visual cortices), which strengthens the connectivity between these various brain regions. Studies have shown that music instruction, even more so than increased math instruction, is associated with better math learning. Students who participate in dramatic enactments of text in the classroom show improved comprehension and oral expression skills, which are even transferred to new materials and situations. Visual arts instruction is associated with higher-level critical thinking, problem solving, sustained attention, and creative imagination, even when controlling for socio-economic status and geography. Recent research indicates that singing may facilitate vocabulary and foreign language learning. Dance instruction improves memory, lowers anxiety (making students more available for learning), and enhances visual-spatial processing.¹

Tips:

- Consult with fine arts teachers routinely regarding lesson planning. It doesn't always have to be large scale; teachers can identify small ways to incorporate music, dance, drama, and visual arts into lesson plans.
- Allow students to make short films, PSAs, or documentaries. Take frequent

advantage of student role-playing.

- The STEAM framework (Science, Technology, Engineering, Arts, and Mathematics) is a natural mechanism for integrating arts into curricula.
- Professional development is plentiful in the area of arts integration; reticent teachers should take advantage of such offerings.

4. We are first and foremost social.

Through and through, we are social creatures. Many psychological theories of motivation suggest that connectedness, meaning, and achievement are core psychological needs; so the ability to relate successfully with others is an essential life skill. Some children learn social skills innately, but others need more explicit instruction and rehearsal. The best schools promote mastery in both the academic and the social domain. Learning has to be social, and social skills need to be part of learning. Simply tacking on a canned social-emotional curriculum is not sufficient; social-emotional development is a process, not a program. Rather, schools need to develop a culture that integrates social and emotional learning that is seen as equal in importance to academics. There is a growing body of research evidence that social-emotional learning has a direct impact on other aspects of student functioning.

Tips:

- Adopt a common framework for your school for social-emotional learning. Approaches to social-emotional learning work best when the faculty, parents, and students center around a shared vocabulary and framework for social-emotional learning.
- Use backwards design to develop lesson plans targeting specific social-emotional outcomes with the academic content as a vehicle (e.g., increased empathy, better communication, skills in providing constructive criticism to others).
- If your school assigns grades, include an element of social skills development related to group projects.
- Remember that just as academic skills develop at different rates for children and adolescents, so do social-emotional competencies. Therefore, social-emotional curricula need to be developmental-specific and able to be differentiated to adapt to current students' needs.

5. We are all wired differently. Literally.



Take a look at the students in the picture. At the time of the photograph, they were both in seventh grade and about the same age. We might remark on their size difference, but we know intuitively that the pace of kids' physical development is all over the map. (You should know that the student on the right is now over 6 feet tall!) For some reason, though, we structure schools expecting that one part of students' bodies will unfold at exactly the same pace: their brains. In fact, the unfolding of brain development is just as uneven as physical development, and when you look at your classes and see an enormous range of body sizes, you can expect that you have the same broad range of brain development.

There is, in fact, little support from the neurodevelopmental literature that defends using age as the primary sorting metric for learning, yet that is exactly what we do in schools. To further complicate things, even brains that are unfolding at a similar pace acquire learning differently, literally wiring in different patterns to solve the same problems. This has significant implications for an educational model that has historically expected children of a certain age to learn the same things in the same way, to express what they know in the same way, and to do so at exactly the same pace. This model is a gross violation of what we know about learning.

To exacerbate things, we infuse this same-age model with a limited view of what constitutes intelligence. Traditional cognitive ability, or "IQ" tests, mainly measure analytical intelligence, the ability to solve problems and complete academic work ("book smarts"). While this notion of IQ predicts ability to solve new problems, ease of learning new information, and school performance (particularly in older students), it does not predict future occupational success, happiness, or adaptability. Researchers such as Robert Sternberg have maintained that analytical intelligence is only a thin sliver of human abilities.² Other abilities such as social-emotional intelligence ("EQ" or emotional intelligence), creative intelligence, and practical intelligence are equally important and present a more robust picture of the human condition.

Part of the natural span on human cognition includes students whom we

euphemistically label as “learning differently.” This is a misnomer. We all learn differently, and if we structure classrooms to reflect this biological reality, then we automatically expand the range of learners whose needs we are able to meet. This is the thrust of the movement, Universal Design for Learning (UDL; see cast.org for more information). UDL originated in architecture with the question, “How can we design a building from the ground up that works for people of all mobilities and abilities, rather than designing for able-bodied people and then slapping a ramp on it?” The extension to education asks, “How can we design learning so that it works for students of various profiles at the same time?” UDL’s three principles are simple to understand. First, learning opportunities should be designed to be accessible to multiple modalities, as described in the section above on multisensory learning. Second, students should have the opportunity to express their learning in multiple ways. Third, student interest should be factored into the choices of what to learn. By expanding modalities, introducing increased movement, and soliciting student interests and passions, you create a classroom that is more accessible to a wider range of learners, without undermining the challenge and rigor for all students.

Tips:

- When planning lessons, build multisensory experiences into your presentation of information, and give choices about how students show their understanding.
- Ask your students to evaluate your teaching, telling them that your goal is to meet their needs and you’d like them to let you know how you are doing. Ask them what would make the lessons better.
- Build in as much small and gross motor movement as possible into lessons.

6. We use executive function skills all the time to adapt to our environment.

Executive functioning refers to a collection of cognitive processes that are responsible for guiding, directing, and monitoring thinking, emotions, and behavior, especially in novel problem-solving situations. Executive functions are responsible for purposeful, goal-directed problem-solving behavior. Researchers have not yet arrived at a consensus about how many distinct executive functions exist or even how to define them or what to call them. In most models, executive functioning will include behaviors such as focusing and sustaining attention; organization of materials and personal space; inhibiting action (e.g., thinking before responding; refraining from a behavior); task initiation; planning and organizing how to

approach a problem; time management; self-monitoring (i.e., being able to analyze one's own performance/behavior and to make mid-course corrections); regulating emotions (both positive and negative) effectively and appropriately for the situation; persisting with goals; and metacognition (i.e., thinking about one's own thinking; reflecting deeply on strengths and weaknesses to develop strategies).

Students with weaknesses in executive functioning are often described as having a breadth of knowledge but difficulty with organizing and outputting such information in a coherent way, similar to a sports team that is lacking a coaching staff who are working together effectively to direct the team. Unfortunately, too often parents and educators expect these skills to develop organically. One phrase that gives us pause is when teachers or parents say, "You are in X grade now, and therefore you should be able to do Y behavior all on your own." Educators have tremendous empathy (and interventions) for students with learning difficulties; but for students who struggle with executive functioning, educators will often attribute these difficulties to laziness, immaturity, or a character flaw. It's the same brain that causes both learning difficulties and executive functioning difficulties! Because research has shown that executive functioning skills are a stronger predictor of school and vocational success than IQ, educators need to incorporate explicit teaching of executive functioning.

Tips:

- The focus for younger children should focus on foundational executive functions (e.g., attention, inhibition, emotional regulation). As students get older (particularly into middle and high school), the more advanced executive functions (e.g., planning, time management, metacognition) should be the focus.
- Integrate executive functioning into lesson plans. For example, if students are doing a "Famous Americans" project, there are opportunities to focus on planning, time management, self-monitoring (i.e., editing), and metacognition (e.g., "How difficult or easy was that for me?" "What strategies worked best for me?").
- Students may not be aware of the executive functioning challenges. The first step is raising students' awareness. Once students are self-aware, adults can provide external structures and supports to help them develop a particular skill. Adults can start to fade these structures (i.e., give reminders to activate a strategy), and they can eventually fade the external support completely once the skill becomes internalized in the students.
- Be patient and persistent! Developing executive functions is a process that

extends into the late 20s. Teachers may not see the fruits of the labor in the short term. Repetition over time is key.

Conclusion: Creating a Brain-Friendly School Environment

We maintain that the various progressive pedagogical movements and calls to change the traditional school model are in keeping with current neuroscience, provide an enriched environment that optimizes learning, and satisfy the proclivities of our “paleo brains.” In order to maximize how the brain learns best, educational reform needs to prioritize multisensory teaching, frequent opportunities for movement, and integration of the creative arts into the school experience. Social-emotional development needs to be as much of a priority as academic skills. Fixed mindsets about IQ and the trajectory of child development need to change. Executive functioning skills should be taught explicitly, as an integrated component of lesson plans. With all of these initiatives, educators need to be informed consumers and enhance their skills in separating good brain research from pseudoscience. We strongly encourage educators to implement curricula and teaching approaches that emerge from well-designed, replicated research studies in peer-reviewed journals and to maintain healthy skepticism about educational fads that purport to be “brain-based.”

Notes

1. Scott Edwards, “Dancing and the Brain,” *On the Brain: The Harvard Mahoney Neuroscience Institute Newsletter* (2017); online at <http://neuro.hms.harvard.edu/harvard-mahoney-neuroscience-institute/brain-newsletter/and-brain-series/dancing-and-brain>.
2. Robert J. Sternberg, *Beyond IQ: A Triarchic Theory of Human Intelligence* (New York: Cambridge University Press, 1985).

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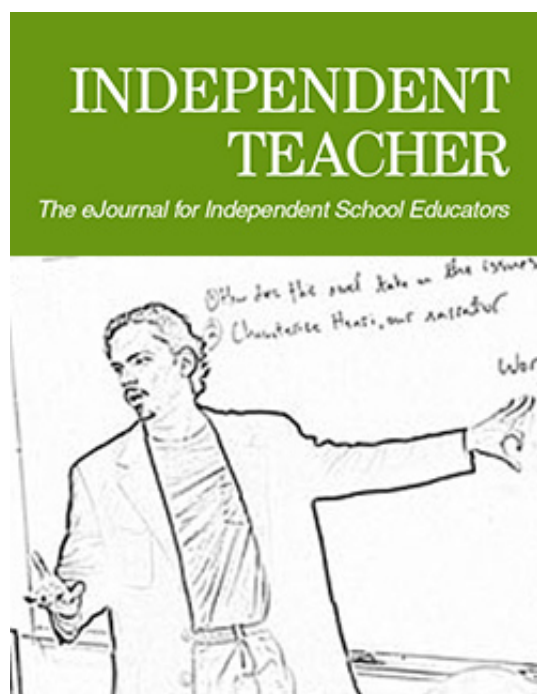
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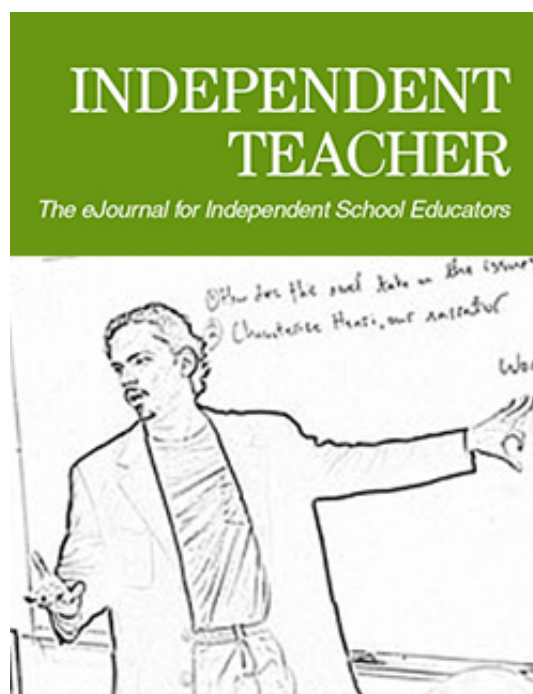
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